IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	08/970,066 Confirmation No.: 2141
Applicant(s)	:	Pradeep K. Dhal et al.
Filed	:	November 13, 1997
Title	:	HOLOGRAPHIC MEDIUM AND PROCESS
	:	FOR USE THEREOF
TC/A.U.	:	1756
Examiner	:	M.J. Angebranndt
Docket No.	:	8232-CPA
Customer No.:		20349

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

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Sir:

This is an appeal from the final rejection of claims 28 - 40 of the application as set forth in the Office Action, made final, mailed October 9, 2003.

REAL PARTY IN INTEREST

The real party in interest in this appeal is Polaroid Corporation, a corporation organized and existing under the laws of the State of Delaware, of 1265 Main Street, Waltham, MA 02451.

RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

STATUS OF CLAIMS

1. Claims 36 - 38 have been rejected under the first paragraph of 35 U.S.C. § 112 as failing to comply with the written description requirement.

2. Claims 28 - 40, all the claims in the application, have been rejected as being unpatentable over the references applied in support of the rejections.

STATUS OF AMENDMENTS

The Amendment After Final which was filed April 6, 2004 has been entered.

In the Advisory Action, mailed May 4, 2004, it was stated that the following rejections had been overcome:

1. The rejection of claims 28 - 35, 39 and 40 under the first paragraph of 35 U.S.C. § 112.

2. The rejection of claims 28 - 31, 39 and 40 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,702,846 ("Sato et al.") in view of U.S. Patent 4,950,567 ("Keys et al.")

SUMMARY OF INVENTION

Appellants' claims are directed to a volume hologram recording medium which includes, an acid generator capable of producing an acid upon exposure to actinic radiation, a binder and both a difunctional epoxide monomer or oligomer and a polyfunctional epoxide monomer or oligomer which are capable of undergoing cationic polymerization initiated by the acid produced by the acid generator.

In processes for the formation of volume phase holograms, interference fringes are formed within a holographic recording medium including a homogeneous mixture of at least one polymerizable monomer or oligomer which is sensitive to the radiation used to form the interference fringes. In order to form a stable volume phase hologram the binder and the monomer(s) or oligomer(s) can not form one chemical structure during polymerization.

In the illuminated regions of the interference fringes, the monomer or oligomer undergoes polymerization to form a polymer that has a refractive index different from that of the binder. Diffusion of the monomer or oligomer into the illuminated regions, with consequent chemical segregation of binder from these areas and its concentration in the non-illuminated regions, produces spatial separation between the polymer formed from the monomer or oligomer and the binder, thereby providing the refractive index modulation needed to form the volume phase hologram.

Some prior art processes for forming holograms utilize free radical polymerization to form the polymerized species. Such free radical-polymerized media may suffer from a number of disadvantages including requiring a lengthy thermal post-exposure treatment to further develop the index modulation of the hologram.

One important use for volume phase holograms is in digital data storage; the three dimensional nature

of a volume phase hologram, coupled with the high information density and parallel read/write capability which can be achieved, renders volume phase holograms particularly suitable for use in high capacity digital data storage. In theory, compact devices having storage capacities in the terabyte (10^{12} byte) range should readily be achievable. However, the disadvantages of free radical-polymerized holographic media, especially the lengthy thermal treatment, which are particularly serious when the media are to be used for digital data storage, have been a drawback.

International Patent Application Publication No. WO 97/13183, ("Dhal et al.") which has certain inventors in common, and a common assignee, with the present application, has been cited as a reference in support of certain of the rejections applied against certain of the claims. Dhal et al. describes holographic recording media which rely upon cationic polymerization without requiring free radical polymerization thereby eliminating the problems of volume phase media formed by free radical polymerization.

The claimed subject matter of appellants is directed to a volume holographic recording medium which includes both a difunctional epoxide monomer or oligomer and a polyfunctional epoxide monomer or oligomer. Appellants have discovered that the claimed holographic recording media with a combination of difunctional epoxide monomers or oligomers and polyfunctional epoxide monomers or oligomers record volume holograms with very

low shrinkage thus rendering these media particularly suitable for use in digital data storage applications.

The binder, as recited in the claims, is defined as to "... not inhibit cationic polymerization of said difunctional and polyfunctional monomers or oligomers ..." and is further characterized in that "... the refractive index of said binder is significantly different from that of the polymerized difunctional and polyfunctional monomers or oligomers...".

The recording medium is further characterized as being "... essentially free from material capable of free radical polymerization.

The present inventors have discovered that holographic recording media based upon a mixture of difunctional epoxide monomers or oligomers and polyfunctional epoxide monomers or oligomers record with low shrinkage rendering these media particularly suitable for digital data storage applications and, further, these recording media have lower threshold exposure energy requirements thus allowing increased writing speed in such applications.

REFERENCES APPLIED BY EXAMINER

1. Canadian Patent No. 995843 ("Watt").

2. U.S. Patent No. 5,124,233 ("Meier et al.").

3. International Patent Application Publication No. WO 97/13183 ("Dhal et al.").

4. U.S. Patent No. 5,698.345 ("Ohe et al.").

5. U.S. Patent No. 4,950,567 ("Keys et al.").

6. U.S. Patent No. 5,702,846 ("Sato et al.")

7. J. Polymer Science, Vol. 28A, pp 479-503 ("Crivello et al.").

8. European Patent Application 0 391 162 ("Eckberg et al.")

DISCUSSION OF THE REFERENCES

1. Watt is directed to a liquid composition of a blend of epoxide materials for coating and related applications. Although this reference does disclose compositions including di- and multifunctional epoxide compounds (see, for example, Example 26 cited by the examiner) there is no suggestion whatsoever for forming volume phase holograms.

2. Meier et al discloses positive-working photoresist compositions including an epoxide resin, a latent urea or imidazole hardener for the epoxide resin and a particular specified iron-arene complex.

3. Dhal et al. discloses a process in which a volume phase hologram is formed by cationic polymerization within a holographic medium. Among the cationically polymerizable monomers and oligomers

disclosed by Dhal et al. are the difunctional monomers disclosed in the present application.

However, Dhal et al. does not disclose or suggest the use of difunctional and polyfunctional monomers or oligomers in combination as is encompassed by the claims of the present application.

4. Ohe et al. teaches a photosensitive recording material which includes a solvent-soluble thermosetting epoxy oligomer capable of cationic polymerization. The reference teaches that when the medium is subjected to holographic exposure, radical polymerization occurs and only a latent image is formed. Subsequent application of heat is required to actually produce a volume type phase hologram.

5. Keys et al. teaches a recording medium which has solid ethylenically unsaturated carbazole monomers which typically contain the ethylenically unsaturated group in the terminal position. Such monomers are polymerized solely by employing free radical polymerization to produce a cross-linked polymeric material. There is no mention of cationic polymerization in the reference.

6. Sato et al. teaches the use of various siloxane monomers in holographic recording media in the overall context of increasing refractive index modulation which results in increased diffraction efficiency. The reference teaches that it is preferred

to use a holographic recording medium that employs free radical poltmerization of ethylenically insaturated monomers for holographic image foemation.

The reference also teaches cationic polymerization of siloxane monomers, which may be multifunctional, but in a post-illumination step that uses irradiation of UV light and/or visible light on the total surface of the imaging medium. Further, the reference nowhere suggests the use of a specific combination of difunctional and polyfunctional monomers or oligomers.

7. Crivello et al. teaches various silicon-containing epoxy monomers and their properties but does not contemplate their use in a holographic recording medium.

8. Eckberg et al. teaches the use of hydroxyfunctional compounds with epoxyfunctional silicone compositions for coatings which have useful release properties. The reference contains no disclosure with respect to volume holographic recording media.

ISSUES

A. Whether the subject matter of claims 36 - 38 complies with the written description requirement established by 35 U.S.C. § 112.

B. Whether the subject matter of claims 28 and 30 is unpatentable under 35 USC § 103(a) over Watt.

C. Whether the subject matter of claim 28 is unpatentable under 35 USC § 103(a) over Meier et al.

D. Whether the subject matter of claims 28 - 31, 39 and 40 is unpatentable under 35 USC § 103(a) over Dhal et al. in view of Ohe et al. and Keys et al.

E. Whether the subject matter of claims 28 - 31, 39 and 40 is unpatentable under 35 USC § 103(a) over Dhal et al. in view of Ohe et al., Keys et al. and Sato et al.

F. Whether the subject matter of claims 28 - 40 is unpatentable under 35 USC § 103(a) over Dhal et al. in view of Ohe et al., Keys et al. Crivello et al. and/or Eckberg et al.

GROUPING OF CLAIMS

Pursuant to 37 CFR 1.192(c)(7), appellants request that all the claims on appeal be considered as a single group.

ARGUMENT

I. The Section 112 Rejection

Summary

Claims 36 -38 comply with the written description requirement for patentability established by 35 U.S.C. § 112.

Detailed Argument

Claims 36 - 38 have been rejected under the first paragraph of 35 U.S.C. § 112 as failing to comply with the written description requirement. In support of the rejection the examiner has stated that the limitation of p to 3 or more in formula (IV) does not have any basis in the application as filed.

The limitation in formula (IV) of p to 3 or more is supported by the disclosure of the application as originally filed. At page 6, lines 23 and 24, the specification states that "[A] variety of tri- tetra- and higher polysiloxanes have been found useful as the polyfunctional monomer in the present medium and process." This is a general statement which refers to any and all of the specific formulae for polyfunctional siloxanes later shown in the specification.

The specification goes on to specify various such polysiloxanes including the monomers of formula (II), which have from 3 to 10 siloxane groups (n = 3 to

10), and those of formula (III) which have 3 siloxane groups.

At page 7, lines 23 and 24, the specification states "[A] second preferred group of polyfunctional monomers ….are those of the formula" (emphasis added) followed by formula (IV) which appears at the top of page 8.

In formula (IV) the moiety $[SiR^7R^8O]_p$ is the epoxide moiety since R^8 is defined as a "monovalent epoxy functional group having 2 - 10 carbon atoms". Originally, the subscript p was defined as being any integer. However, it is apparent that the compounds defined by formula (IV) can only be polyfunctional where p is at least 3.

The examiner has stated that "[T]he basis for 2-10 or 3-10 siloxane groups refers to those embraced by other formulae and not to formula IV and therefore have no bearing on that formula." Appellants do not rely on the number of siloxane groups in the other formulae as support for the definition of p being 3 or more in formula IV. Reference has been made to the other formulae to show that the specification teaches that all the polyfunctional monomers disclosed in the application and recited in the claims have to have at least three siloxane groups.

To summarize, it is appellants position with respect to formula IV, that the specification clearly describes the monomers of formula IV as "polyfunctional"

and in order for the compounds defined by formula IV to be polyfunctional, p has to be at least 3.

In order to comply with the written description requirement of the first paragraph of Section 112 it is not necessary that the exact language in the claims appear in the specification. It is sufficient that the language recited in the claims be supported by the disclosure of the specification in a clear manner. Here, given the original definition of "p" as an integer and the additional fact that formula (IV) clearly is stated as defining polyfunctional siloxane monomers and that such monomers could be polyfunctional only where p is 3 or more, the amendatory language is clearly supported by the original disclosure and amended claim 36, together with dependent claims 37 and 38 comply with the written description requirement of Section 112.

The examiner has stated that "[T]he applicant would be permitted to amend the claims to use the teachings of U.S. Patent 5,523,374 with respect to the embodiments of formula IV based upon the language of the specification, but the teachings in that patent seem to be 6-11 siloxane units." The '374 patent does show a polysiloxane monomer (column 7, lines 51 - 67) having from 6 to 11 siloxane units. The disclosure of the particular polysiloxane monomer in the '374 patent is in the context of preferred siloxanes for use in the compositions disclosed therein. That teaching does not in any way indicate that the number of siloxane units in

formula (IV) of the present application should be the same.

II. The Art Rejections

Summary.

There is no suggestion or incentive to be found in the references cited to support the obviousness rejections which would place one skilled in the art in possession of the claimed subject matter as is required to properly support rejections under 35 U.S.C. § 103(a).

Discussion of the Invention.

As discussed previously, the present inventors have discovered that holographic recording media based upon a mixture of difunctional epoxide monomers or oligomers and polyfunctional epoxide monomers or oligomers record with low shrinkage rendering these media particularly suitable for digital data storage applications and, further, these recording media have lower threshold exposure energy requirements thus allowing increased writing speed in such applications.

During prosecution the Affidavit Under 37 CFR § 1.132 of David A. Waldman, one of the applicants in the application, was submitted. The affidavit presents data relating to the formation of volume holograms by cationic polymerization for a composition which includes only a difunctional epoxide monomer (the "prior art") and for two compositions according to the present

invention, one of which includes the same difunctional epoxide monomer and a tetrafunctional epoxide monomer and the other of which includes the same difunctional epoxide monomer and a trifunctional epoxide monomer.

The data show conclusively that for the volume holographic recording media according to the invention stable volume holographic formation is obtained with a relatively lower threshold exposure fluence whereas for the volume holographic recording medium which included only the difunctional epoxide monomer stable volume holographic formation is observed at a much later time period with a much higher threshold exposure fluence. These results are unexpected in view of the prior art teachings.

The data show that the unexpected differences in the results obtained for the volume holographic recording media according to the invention are due to the combination of the difunctional and polyfunctional epoxide compounds since the reactive groups in each compound are identical. The much higher threshold energy fluence required for the difunctional epoxide monomer to provide stable volume holographic formation indicates that although chemical reaction is taking place upon exposure, volume holographic image formation is not occurring as quickly as in the case of the media which contain both difunctional and polyfunctional epoxide compounds. The unexpected much faster stable volume holographic formation provided by the recording media of

the invention is critical for digital holographic data storage applications.

A higher molecular weight structure can be achieved by the claimed recording medium for the same number of photo-initiation events because of cross-linking. According to the invention, stable molecular structures for stable volume holograms can be achieved with fewer photo-initiation events.

The affidavit also presents data relating to the volume change (shrinkage) of liquid monomers and the solid polymerized films of the monomers for a difunctional epoxide monomer, a trifunctional epoxide monomer and a tetrafunctional epoxide monomer, each of the monomers having the same chemical structure for the epoxy grouping. The data show significantly reduced volume shrinkage for the films made with the tri- and tetrafunctional epoxide monomers in comparison to the film made from the difunctional epoxide monomer.

Issue (b).

Claims 28 and 30 define subject matter which is patentably distinguishable within the meaning of 35 U.S.C. § 103(a) over the teachings of Watt.

The examiner has referred to the contents of the composition of Example 18 of Watt and has concluded that it would be obvious to include therein poly(vinyl pyrollidone) which is taught in Example 25 (page 38) as inhibiting premature gelation of a polymerizable epoxide composition.

The composition disclosed in Example 18 of Watt does include di- and multifunctional epoxide compounds (as well as a monofunctional epoxide compound) but does not include any binder material let alone an inert binder material as recited in the present claims. Even, assuming arguendo, that it would be obvious to include poly(vinyl pyrollidone) in the composition of Example 18 the resulting composition would not be suitable to form a volume hologram.

In order to form a stable volume hologram the binder and the monomer(s) can not form one chemical structure during polymerization. It is necessary that there be chemical segregation between the binder material and the resulting polymerized species formed in order to obtain a volume hologram. Appellants' claims recite specifically that the binder does not inhibit cationic polymerization of the difunctional and polyfunctional monomers or oligomers and the refractive index of the binder is significantly different from that of the polymerized difunctional and polyfunctional monomers or oligomers.

Poly(vinyl pyrollidone), if incorporated in the composition of Example 18 would inhibit cationic polymerization of the epoxide monomers and, further, the refractive index difference between the poly(vinyl pyrollidone) and the polymerized structure obtained from the epoxy materials would not be suitable to form volume holograms of sufficient strength.

In order for a reference to provide proper support for a rejection under Section 103 it is necessary that there be a suggestion or incentive for those skilled in the art to modify the teachings of the reference to arrive at the claimed subject matter. Here, there is no incentive found in Watt to incorporate in the composition of Example 18 a binder of the type which is necessary for the formation of a volume phase hologram.

Further, the composition described in Example 18 of Watt includes allyl glycidyl ether, a material capable of free radical polymerization. Claim 28, upon which claim 30 is dependent, recites that the volume hologram recording medium "...is essentially free from materials capable of free radical polymerization".

For these reasons, Watt does not provide the requisite teaching to support the rejection of claims 28 and 30.

Issue (c).

Claim 28 defines subject matter which is patentably distinguishable within the meaning of 35 U.S.C. § 103(a)over the teachings of Meier et al.

In support of the rejection the examiner has referred to Example 3 of the reference and has pointed out that the addition of a binder is disclosed as rendering the composition aqueous developable.

As has been pointed previously, in order to form stable volume holograms, the claimed compositions of appellants require a particular type of binder material. The binder, as recited in claim 28, is one which does not inhibit cationic polymerization and which has a refractive index significantly different than that of the polymerized difunctional or polyfunctional monomers or oligomers.

The teaching of Meier et al. does not suggest to those skilled in the art to add to any composition the specific type of binder material recited in claim 28. The compositions of Meier et al. are taught for use as photoresists. The teaching to add a binder to render the composition aqueous developable has to be interpreted in the context of the overall disclosure. There is no suggestion in Meier et al. to use such compositions for the formation of volume holograms and it follows that there is no suggestion to incorporate into such a composition the type of binder material necessary to provide a composition which is suitable to form volume holograms.

For these reasons, Meier et al. does not provide the requisite teaching to support the rejection of claim 28.

Issue (d).

Claims 28 - 31, 39 and 40 define subject matter which is patentable within the meaning of 35 USC

§ 103(a) over the teachings of Dhal et al. in view of Ohe et al. and Keys et al.

Dhal et al. has the same assignee as the present application and represents an earlier stage in the development of the imaging medium claimed in the present application. Dhal et al. discloses a process in which a volume phase hologram is formed by cationic polymerization within a holographic medium. Among the cationically polymerizable monomers and oligomers disclosed by Dhal et al. are the difunctional monomers disclosed in the present application. However, Dhal et al. does not disclose the use of difunctional and polyfunctional monomers or oligomers in combination as is recited in the present claims.

The discussion in Dhal et al. regarding the choice of monomer or oligomer is at page 6, line 21 to page 7, line 8. All the worked examples of Dhal et al. use either the compound of Formula (I) in which R is a methyl group or a 1,2-epoxy-1,2,3,4-tetrahydronaphthalene as the polymerizable monomer.

Ohe et al. teaches a photosensitive recording material which includes a solvent-soluble thermosetting epoxy oligomer capable of cationic polymerization. It is important to recognize that this reference teaches that when the medium is subjected to holographic exposure radical polymerization occurs and only a latent image is formed. Subsequent application of heat is required to actually produce a volume type phase hologram.

The reference teaches that the volume hologram can not be formed by overall exposure to UV or other actinic irradiation after the holographic exposure and before heat treatment and states that the reason for this is that the additional exposure to laser interference light before heat treatment will result in generation of acid species that will be uniformly distributed thereby preventing the required formation of a permanently chemically segregated structure necessary for volume phase hologram formation. Additionally, Ohe et al. teaches that cationic polymerization occurs specifically during the subsequent heat treatment step.

Accordingly, the fact that the medium of Ohe et al. only forms a latent image during exposure to actinic radiation and then requires an immediate heating step to form a volume hologram renders the medium entirely unsuitable for multiplexed image recording which is required for holographic data storage. The reference does not teach anything with respect to a volume holographic recording medium that can form volume holograms solely by cationic polymerization initiated by exposure to actinic radiation.

Keys et al. teaches a recording medium which has solid ethylenically unsaturated carbazole monomers which typically contain the ethylenically unsaturated group in the terminal position. Such monomers are polymerized solely by employing free radical polymerization to produce a cross-linked polymeric

material. There is no mention of cationic polymerization as is required by the present claims.

This reference teaches the enhancement of the diffraction efficiency of reflection holograms by utilization of a post-exposure, i.e., subsequent to hologram formation, thermal treatment step. It is in the context of attaining improvement in refractive index modulation after image formation that Keys et al. teaches the use of multifunctional monomers. Keys et al. also teaches (column 13, lines 1 -10) that the thermal treatment can concurrently fix the enhanced hologram by thermally hardening or polymerizing the material in the hologram. This will, of course, be accompanied by additional volume shrinkage.

Thus, Keys et al. does not teach or suggest anything with respect to the use of multifunctional monomers or oligomers being important to the formation of volume holograms during imaging and, further, does not teach anything regarding reduction of volume shrinkage which otherwise accompanies polymerization reactions.

One skilled in the art would find no suggestion in Keys et al. which would provide an incentive to take from Keys et al., out of the context of the overall teaching of the reference in which the use of multifunctional monomers is described, to use multifunctional monomers in the method of Dhal et al. in conjunction with difunctional monomers or oligomers.

In summary, Ohe et al. and Keys et al. do not provide the teaching which is lacking in Dhal et al with respect to the presently claimed volume holographic recording medium. Neither of these references teaches or suggests formation of volume holograms solely by cationic polymerization initiated by exposure to imagewise actinic radiation. These references, viewed individually or in combination, would not place the public in possession of appellants' presently claimed volume holographic recording medium as is required to support a rejection under Section 103(a).

For these reasons, Dhal et al., Ohe et al. and Keys et al., in combination, do not provide the requisite teaching to support the rejection of claims 28 - 31, 39 and 40.

Issue (e).

Claims 28 -31, 39 and 40 define subject matter which is patentable within the meaning of 35 USC § 103(a) over the teachings of Dhal et al. in view of Ohe et al., Keys et al. and Sato et al.

In support of the rejection the examiner has referred to: the Sato et al. teaching of: useful cationic polymerizable compounds; the use of compounds having siloxane groups increases the refractive index modulation; the use of multiple epoxides is disclosed; Example 2 includes a cationically polymerizable siloxane compound, a free radically polymerizable compound, photoinitiators for each and a polymeric binder.

The examiner has also referred to Keys et al. for the teaching that when more cross-linking is desired the use of multifunctional monomers in amounts up to 5% is a means to achieve this result.

The teaching of Sato et al. to use various siloxane monomers in holographic recording media is in the overall context of increasing refractive index modulation which results in increased diffraction efficiency. Sato et al. teaches that it is preferred to use a holographic recording medium that employs free radical polymerization of ethylenically unsaturated monomers for the hologram image formation. This reference also teaches cationic polymerization of siloxane monomers, which may be multifunctional, but in a post imaging flood illumination step that uses iradiation of UV light and/or visible light on the total surface of the imaging medium.

Sato et al. does not teach the usefulness, as recited in the present claims, of a siloxane monomer in a volume holographic recording medium which employs only cationic polymerization to form volume holograms. Further, the reference does not teach or suggest the use of a specific combination of difunctional and polyfunctional monomers or oligomers as is required by the present claims.

The Dhal et al., Ohe et al. and Keys et al. references have been discussed in detail above.

It would not be obvious to take from each of Ohe et al., Keys et al. and Sato et al. only so much of

their disclosures, out of the overall context of what the references teach, to support the rejection of the claims.

For these reasons, Dhal et al., Ohe et al. and Keys et al., in combination, do not provide the requisite teaching to support the rejection of claims 28 - 31, 39 and 40.

Issue (f).

Claims 28 - 40 define subject matter which is patentable within the meaning of 35 USC § 103(a) over the teachings of Dhal et al. in view of Ohe et al., Keys et al. Crivello et al. and/or Eckberg et al.

This ground of rejection must fail for the same reasons advanced previously with respect to Dhal et al., Ohe et al. and Keys et al. and further because both Crivello et al. and Eckburg et al. do not teach or suggest volume holographic compositions.

The examiner has alleged that it would be obvious to use other siloxane compounds known to be useful cationically polymerizable materials, such as those disclosed by Crivello et al. and/or Eckberg et al. in place of those specifically used in the examples of Dhal et al. as modified by Ohe et al. and Keys et al. with a reasonable expectation of achieving comparable results. The examiner has also alleged that any cationically polymerizable compound(s) would be useful in the compositions of Dhal et al.

Dhal et al., Ohe et al. and Keys et al. have been discussed above. Crivello et al. has been cited to show the use of various epoxy silane compounds as shown in Tables I and II and Eckberg et al. has been cited to show the use of cationically polymerizable compounds and the properties achieved through their use.

Crivello et al. teaches various silicon-containing epoxy monomers and their properties but does not contemplate their use for a holographic recording medium let alone suggest that such use may be possible.

Eckberg et al. teaches the use of hydroxyfunctional compounds with epoxyfunctional silicone compositions for coatings which have useful release properties. There is absolutely no relationship between the disclosure of Eckberg et al. and the volume holographic recording medium of applicants.

The broad teaching of Dhal et al. does teach each and every possible combination of cationically polymerizable materials within the broad teaching of that reference. The present claims require a specific combination of difunctional and polyfunctional epoxide monomers or oligomers. As discussed in detail above, applicants have found that the claimed combination of materials provides a volume holographic medium with reduced shrinkage rendering these media particularly suitable for use in digital data storage applications and also exhibit lower threshold energy for hologram

formation thus allowing increased writing speed in data storage applications.

These references, viewed individually or in combination, do not properly support the rejection. As pointed out above, in order to properly support a rejection of claimed subject matter under Section 103(a), a reference or references must place the public in possession of the claimed subject. Here, it would not be obvious to take from each of the secondary references only so much of their disclosures, out of the overall context of what the references teach, to support the rejection of the claims.

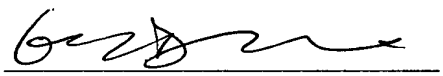
For these reasons, Dhal et al., Ohe et al., Keys et al., Crivello et al. and Eckberg et al., in combination, do not provide the requisite teaching to support the rejection of claims 28 - 40.

In summary, it has been shown that the requisite incentives required by the governing law for the modification and/or combination of the references to arrive at appellants' claimed subject matter are not found in the disclosures of the references. The purported incentives proposed by the examiner for the modifications and/or combinations are simply ex post facto rationalizations which do not meet the burden of establishing obviousness within the meaning of Section 103.

CONCLUSION

For all of the foregoing reasons, the rejection of claims 36 - 38 under the first paragraph of 35 U.S.C. § 112 and the 35 U.S.C. § 103(a) rejections of all the claims on appeal should be reversed and all the claims allowed.

Respectfully submitted,



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APPENDIX

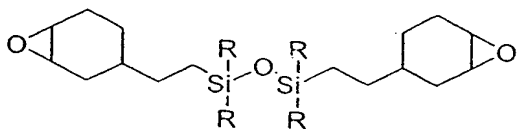
Claims On Appeal

Claim 28: A volume holographic recording medium comprising an acid generator capable of producing an acid upon exposure to actinic radiation; a binder; a difunctional epoxide monomer or oligomer; and a polyfunctional eppoxide monomer or oligomer, the difunctional and polyfunctional epoxide monomers or oligomers being capable of undergoing cationic polymerization initiated by the acid produced from the acid generator, wherein said binder does not inhibit cationic polymerization of said difunctional and polyfunctional monomers or oligomers and the refractive index of said binder is significantly different from that of the polymerized difunctional and polyfunctional monomers or oligomers; and wherein said recording medium is essentially free from material capable of free radical polymerization.

Claim 29: A volume holographic recording medium according to Claim 28 wherein at least one of the difunctional epoxide monomer or oligomer and the polyfunctional epoxide monomer or oligomer comprises a siloxane.

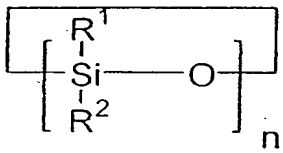
Claim 30: A volume holographic recording medium according to Claim 28 wherein at least one of the difunctional epoxide monomer or oligomer and the polyfunctional epoxide monomer or oligomer comprises a cycloalkene oxide.

Claim 31: A volume holographic recording medium according to Claim 30 wherein the difunctional epoxide monomer is of the formula



wherein each R independently is an alkyl or cycloalkyl group.

Claim 32: A volume holographic recording medium according to Claim 29 wherein the polyfunctional epoxide monomer is of the formula:



wherein each group R^1 is, independently, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aralkyl or aryl group; each group R^2 is, independently, R^1 or a monovalent epoxy functional group having 2-10 carbon atoms, with the proviso that at least three of the groups R^2 are epoxy functional; and *n* is from 3-10.

Claim 33: A volume holographic recording medium according to Claim 32 wherein the polyfunctional epoxide monomer is 1,3,5,7-*tetrakis*(2-(3,4-epoxycyclohexyl)ethyl)-1,3,5,7-tetramethylcyclotetrasiloxane.

Claim 34: A volume holographic recording medium according to claim 29 wherein the polyfunctional epoxide monomer is of the formula:

$$R_3Si(OSi(R^4)_2R^5)_3$$

R_3 is an $OSi(R^4)_2R^5$ grouping, or a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aralkyl or aryl group; each group R^4 is, independently, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aralkyl or aryl group; and each group R^5 is, independently, a monovalent epoxy functional group having 2-10 carbon atoms.

Claim 35: A volume holographic recording medium according to Claim 34 wherein R_3 is a methyl group or an $OSi(R^4)_2R^5$-grouping, each group R^4 is a methyl group, and each group R^5 is a 2-(3,4-epoxycyclohexyl)ethyl grouping.

Claim 36: A volume holographic recording medium according to Claim 29 wherein the polyfunctional epoxide monomer is of the formula:

$$(R^6)_3SiO[SiR^7R^8O]_p[Si(R^7)_2O]_qSi(R^6)_3$$

each group R^6 is, independently, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aralkyl or aryl group; each group R^7 is , independently, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aralkyl or aryl group; each group R^8 is, independently, a monovalent epoxy functional group having 2-10 carbon atoms, p is an integer equal to or greater than 3 and q is an integer.

Claim 37: A volume holographic recording medium according to Claim 36 wherein each group R^6 and R^7 is an alkyl group.

Claim 38: A volume holographic recording medium according to Claim 37 wherein each group R^8 is an 2-(3, 4-epoxycyclohexyl)ethyl grouping and p and q are approximately equal.

Claim 39: A volume holographic recording medium according to Claim 28 comprising from about 0.2 to about 5 parts by weight of the difunctional epoxide monomer or oligomer per part by weight of the polyfunctional epoxide monomer or oligomer.

Claim 40: A volume holographic recording medium according to Claim 28 comprising from about 0.16 to about 5 parts by weight of the binder per total part by

weight of the difunctional epoxide monomer or oligomer and the polyfunctional epoxide monomer or oligomer.

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Mail Stop Appeal Brief-Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: September 8, 2004

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